In Alaska in 1964, a magnitude 9.2 earthquake jarred the earth so strongly it caused fishing boats to sink in Louisiana. What causes the ground tremble like that? The answer is simple. The Earth's surface is on the move.

The surface of the earth, called the "crust," is not one solid piece. It's more like a 20 piece puzzle. Each puzzle piece is called a "plate." The plates constantly move. Fortunately for us, they don't move fast. Geologists estimate the fastest plate might shift 6 inches a year (15 centimeters). That's about as fast as your hair grows.

Earthquakes happen when a plate scrapes, bumps, or drags along another plate. When does this happen? Constantly. About a half-million quakes rock the Earth every day. That's millions a year. People don't feel most of them because the quake is too small, too far below the surface, or deep in the sea. Some, however, are so powerful they can be felt thousands of miles away.

A powerful earthquake can cause landslides, tsunamis, flooding, and other catastrophic events. Most damage and deaths happen in populated areas. That's because the shaking can cause windows to break, structures to collapse, fire, and other dangers.

Geologists cannot predict earthquakes. They hope they will in the future through continued research and improved technology.

Earthquakes can happen anytime or anywhere. But you can prepare for the unpredictable with a family safety plan, emergency kit, and supplies.

# **Earthquakes the basics**

Earthquakes are among the most deadly natural hazards. There are around 100 earthquakes each year of a size that could cause serious damage.

Earthquakes strike without warning and many of the Earth’s earthquake zones coincide with areas of high population density. When large earthquakes occur in such areas the results can be catastrophic, with terrible loss of human lives and untold economic cost.

Seismology is the study of earthquakes and seismic waves. The seismograph records the [seismic waves](http://www.bgs.ac.uk/discoveringGeology/hazards/earthquakes/SeismicWaves.html) generated by earthquakes, allowing the seismologist to determine [where](http://www.bgs.ac.uk/discoveringGeology/hazards/earthquakes/locatingQuakes.html), and how deep, a particular earthquake is. Also, the seismic waves from earthquakes can be used to image the deep interior of the Earth, providing vital clues to the internal structure of our planet.

# **Why and where do earthquakes occur?**

If we look at the pattern of where earthquakes occur around the world, it is clear that most of the earthquake activity is concentrated in a number of distinct earthquake belts.

For instance, there are many earthquakes recorded around the edge of the Pacific Ocean, or in the middle of the Atlantic Ocean.

These earthquake belts provide an important clue in the development of the theory of plate tectonics.

The outer shell of the Earth, or lithosphere, is made up of a number of rigid segments called tectonic plates. These plates are continually moving at rates of a few centimeters per year (about as fast as your fingernails grow), driven by forces deep within the Earth.

Below the lithosphere plates, lies the Earth’s asthenosphere. The asthenosphere behaves like a fluid over very long time scales, allowing it to convect. Convection acts like giant conveyor belts, moving the overlying plates around.

At the boundaries between the plates, where they are moving together, apart or past each other, tremendous stresses build up, and are where most earthquakes occur.

# **How we measure earthquakes**

A seismogram is a record of the seismic waves from an earthquake.

A seismograph or seismometer is the measuring instrument that creates the seismogram.

Almost all seismometers are based on the principle of inertia: a suspended mass tends to remain still when the ground moves.

The relative motion between the suspended mass and the ground will then be a measure of the ground’s motion.

On a seismogram from an earthquake, the P-wave is the first signal to arrive, followed by the slower S-wave, then the surface waves.

The arrival times of the P- and S-waves at different seismographs are used to determine the location of the earthquake.

Given that we know the relative speed of P- and S-waves, the time difference between the arrivals of the P- and S-waves determines the distance the earthquake is from the seismograph.

**FACTS**

• Geologists rate earthquakes in magnitude, which is the amount of energy released during the quake.  
• The largest recorded earthquake happened in Chile on May 22, 1960. It was a magnitude 9.5.  
• The deadliest known earthquake happened in China in 1556. It killed about 830,000 people.  
• Alaska has the record for the largest U.S. earthquake. On March 28, 1964, a magnitude 9.2 quake occurred and killed 131 people.  
• Most earthquakes happen 50 miles (80 kilometers) or less below the Earth's surface. They can happen as deep as 400 miles (644 kilometers) below the surface.  
• Southern California has about 10,000 earthquakes a year. Very few are felt.  
• Alaska averages 24,000 earthquakes a year, the most seismic activity in North America.  
• Florida and North Dakota have the fewest earthquakes in the U.S.  
• In 1985, the jolt from an 8.1 magnitude earthquake in Michoacán, Mexico caused water to slosh out of a pool in Tucson, Arizona—1240 miles (2000 kilometers) away!  
• Most earthquakes and volcanoes—80%—happen close to where two plates meet.  
• Depending on the plate, they move between 0.3 to 5.9 inches a year (1 to 15 centimeters) a year.  
• Because of moving plates, geologists predict that Los Angeles will meet Alaska... in 70 million years! (It'll be neighbors with San Francisco in 15 million years.)